

REMARKS

Claims 1-5 and 12-16 are pending in the application.

Claims 1-5 are rejected under 35 U.S.C. § 112.

Claims 1-5, and 12-16 are rejected under 35 U.S.C. § 103(a).

The specification is amended.

No new matter is added.

Applicant requests reconsideration and allowance of the claims in light of the above amendments and following remarks.

Claim Rejections – 35 U.S.C. § 112

Claims 1-5 are rejected under 35 U.S.C. § 112, first paragraph, as allegedly failing to comply with the written description requirement. Applicant respectfully traverses this rejection.

The Office Action asserts that the specification does not show that Applicant was in possession of “a metallic layer on a back surface of a chip without an intervening layer therebetween.” Specifically, the Office Action asserts that Applicant’s arguments presented October 5, 2006 and pertaining to page 6, line 29 to page 7, line 6 of the specification as originally filed are unpersuasive because “nothing in Applicant’s specification or alleged analysis would enable one skilled in the art with reasonable clarity that Applicant was in possession of a ‘metallic layer on a back surface of a chip without an intervening layer therebetween’.” The Office Action appears to support this conclusion because the sentence “[w]ith respect to the adhesive means and the temperature in the chip attachment process, it is preferable to use a metal having a low melting point as the metallic layer 115,” found at page 7, lines 6-8 of the specification as originally filed, allegedly “suggests that there is an intervening adhesive ... denoted by the phrase ‘adhesive means’.” Applicant respectfully disagrees.

When read in the context of the entire application, however, the “adhesive means” recited at page 7, lines 6-8 of the specification refers to the metallic adhesive 130 – not to an intervening adhesive between the metallic layer 113 and the semiconductor chip 112. This interpretation of “adhesive means” is clearly supported when read in the context of the specification as a whole. For example, page 4, lines 19-20 of the specification as originally filed states wherein a method for manufacturing digital micro-mirror device (DMD) packages “also comprises attaching each semiconductor chip to an upper surface of a base substrate with an adhesive made of a metal

having a low melting point.” Page 4, line 32 of the specification as originally filed states that “[s]older is preferably used as the metal adhesive having a low melting point.” Page 6, lines 10-12 of the specification as originally filed states that “a semiconductor chip 112 is attached to an upper surface 121 of a base substrate 120 with a metallic adhesive 130 having a low melting point.” Page 7, lines 27-29 of the specification as originally filed states that “[e]ach of the semiconductor chips 112 is separated from the wafer (110 in FIG. 11), and attached to the upper surface 121 of the base substrate 120 by interposing an adhesive 130 having a low melting point such as solder therebetween.” Page 10, lines 4-5 of the specification as originally filed states that “instead of the Ag-epoxy adhesive, a metal having a low melting point such as a solder can be used in the chip-attaching step.” Upon considering the specification as originally filed, in its entirety, it is clear that the metallic adhesive 130 (also referred to as “adhesive 130” and “metal adhesive 130”) is formed of a metallic material having a low melting point and is used to attach the semiconductor chip 112 to the upper surface 121 of the base substrate 120.

Thus, where the aforementioned passage at page 7, lines 6-8 states “[w]ith respect to the adhesive means and the temperature in the chip attachment process, it is preferable to use a metal having a low melting point as the metallic layer,” Applicant respectfully submits that the “adhesive means” (which is described as having a low melting point and being used in chip attachment) actually refers to metallic adhesive 130 – not to some adhesive intervening between the metallic layer 113 and the semiconductor chip 112. Accordingly, Applicant hereby amends the specification to provide consistent use of the term “metallic adhesive 130,” thereby eliminating possible sources of confusion within the specification and further submits that no new matter has been added.

Because the “adhesive means” recited page 7, lines 6-8 of the specification as originally filed refers to the metallic adhesive 130 – not to some adhesive intervening between the metallic layer 113 and the semiconductor chip 112, and by virtue of the absence of any written description supporting an intervening adhesive layer between the back surface 110b of wafer 110 and the metallic layer 115, Applicant respectfully submits that the specification as originally filed supports the element “a semiconductor chip having a metallic layer formed on a back surface of the semiconductor chip without an adhesive layer therebetween” as recited in claim 1.

Claim Rejections – 35 U.S.C. § 103

Claims 1, 3, 4, 12-14 and 16 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,936,758 issued to Fisher, et al. (hereinafter “Fisher”) in view of U.S. Patent No. 4,554,573 issued to Yamamoto, et al. (hereinafter “Yamamoto”).

As a preliminary matter, Applicant notes that the Office Action asserts that Yamamoto teaches a “metallic layer (5) formed without an intervening adhesive layer ... or directly on a back of a chip [(4)].” However, while FIG. 2 of Yamamoto shows adhesion reinforcing film 5 on a back surface of a semiconductor element 4, the specification of Yamamoto fails to explicitly state that the adhesion reinforcing film 5 is formed “directly on” the back surface of the semiconductor element 4 and “without an intervening adhesive layer.” Further, the fact that Yamamoto describes the adhesion reinforcing film 5 is “evaporated” does not preclude the possible use of an intervening adhesive layer between the adhesion reinforcing film 5 and the back surface of the semiconductor element 4. Accordingly, and upon applying the same standards of interpretation used in the Office Action to reject claims 1-5 under 35 U.S.C. § 112, first paragraph, Applicant respectfully submits that Yamamoto fails to teach with reasonable clarity that the adhesion reinforcing film 5 is formed “directly on” the back surface of the semiconductor element 4 and “without an intervening adhesive layer.” Because none of the cited references teach or suggest each and every element recited in claims 1 and 12, Applicant respectfully submits that the combination of Fisher in view of Yamamoto fails to render claims 1 and 12 obvious. See M.P.E.P. § 2143.03.

Further rejecting claims 1 and 12, the Office Action asserts that it would have been obvious to “modify the package of Fisher by incorporating a metallic layer in a manner that is taught by ... [Yamamoto] that is between the chip and adhesive in order to eliminate destruction of device due to stress as taught by Yamamoto.” Applicant respectfully disagrees.

FIGS. 2-4 of Yamamoto illustrate wherein a semiconductor element 4 is bonded to a ceramic substrate 1 using a glass film 2 and describes wherein an aluminum adhesion reinforcing film 5 formed on the back surface of the a semiconductor element 4 prevents “thermal stress which may give rise to destruction of the semiconductor element” from being produced. Accordingly, it appears that the presence of the aluminum adhesion reinforcing film 5 somehow acts to dissipate thermal stresses that the semiconductor element 4 may otherwise have been exposed to. FIG. 1 of Fisher, on the other hand, illustrates wherein a chip is mounted onto the

floor 50 of a base substrate 1, on which an electrically conductive coating 52 has already been formed. Moreover, Fisher describes wherein the chip 12 is adhered to the floor 50 using a thermally conductive adhesive. See Fisher, column 7, lines 9-11.

Because the chip 12 of Fisher is adhered to an electrically conductive coating 52 via a thermally conductive adhesive, Applicant respectfully submits that the conductive coating 52 and thermally conductive adhesive of Fisher would dissipate thermal stresses the chip 12 may otherwise have been exposed to and, therefore, would inherently function in the same manner as the adhesion reinforcing film 5 of Yamamoto. Because the functionality of the adhesion reinforcing film 5 of Yamamoto is already present in Fisher, without modification, Applicant respectfully submits that one of ordinary skill in the art would not find it desirable to modify Fisher using Yamamoto “in order to eliminate destruction of device due to stress,” as asserted in the Office Action. Because one of ordinary skill in the art would not find it desirable to modify Fisher using Yamamoto “in order to eliminate destruction of device due to stress,” Applicant respectfully submits it would be obvious to modify Fisher using Yamamoto as proposed in the Office Action. See M.P.E.P. § 2143.01(I).

For at least the reasons presented above, Applicant respectfully submits that the combination of Fisher in view of Yamamoto fails to render claims 1 and 12 obvious. Claims 3, 4, 13, 14 and 16 variously depend from claims 1 and 12 and, therefore, include each and every element variously recited in claims 1 and 12. Accordingly, Applicant respectfully submits that the combination of Fisher in view of Yamamoto fails to render claims 3, 4, 13, 14 and 16 obvious for at least the reasons presented above with respect to claims 1 and 12.

Claims 2 and 15 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Fisher in view of Yamamoto and further in view of U.S. Patent App. Pub. No. 2001/004564 to Akram (hereinafter “Akram”).

As a preliminary matter, Applicant notes that U.S. Patent App. Pub. No. 2001/004564 does not exist. Based upon the citation of Akram in the Office Action, it appears that the Office Action relies upon U.S. Patent App. Pub. No. 2002/0126452 to Akram, et al. Accordingly, Applicant proceeds under the assumption that U.S. Patent App. Pub. No. 2002/0126452 has been relied upon in the Office Action.

Claims 2 and 15 depend from claims 1 and 12, respectively, and therefore include each and every element respectively recited in claims 1 and 12. As shown above, the combination of Fisher in view of Yamamoto fails to render claims 1 and 12 obvious. Moreover, Akram does not contain any teaching which, when combined with Fisher in view of Yamamoto, renders claims 1 and 12 obvious. Accordingly, Applicant respectfully submits that the combination of Fisher in view of Yamamoto and Akram fails to render claims 2 and 15 obvious for at least the reasons presented above with respect to claims 1 and 12.

Claim 5 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Fisher in view of Yamamoto and further in view of U.S. Patent No. 6,882,042 issued to Zhao, et al. (hereinafter “Zhao”).

Claim 5 depends from claim 1 and, therefore, includes each and every element respectively recited in claim 1. As shown above, the combination of Fisher in view of Yamamoto fails to render claims 1 and 12 obvious. Moreover, Zhao does not contain any teaching which, when combined with Fisher in view of Yamamoto, renders claim 1 obvious. Accordingly, Applicant respectfully submits that the combination of Fisher in view of Yamamoto and Zhao fails to render claim 5 obvious for at least the reasons presented above with respect to claim 1.

Claims 12-14 and 16 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Fisher in view of U.S. Patent No. 5,241,133 issued to Mullen, III et al. (hereinafter “Mullen”).

Rejecting claim 12, the Office Action asserts that it would have been obvious to modify the package of Fisher by “[replacing] high cost ceramic substrates with plastic as taught by Mullen” and, as a result of such a replacement, it would have been obvious to modify the package of Fisher by “incorporating a copper metallic layer between the chip and adhesive in order to reduce stress as taught by Mullen.” Applicant respectfully disagrees.

Mullen discloses that pin grid array packages comprise a substrate with an array of pins extending outward from one face of the substrate to join with sockets on a main PCB. See Mullen, column 1, lines 14-20. Mullen further discloses that “advantages of a plastic pin grid array as compared to a ceramic pin grid array are low cost and better electrical performance.” See Mullen, column 2, lines 1-3. Accordingly, Mullen describes the cost benefits of replacing

ceramic PGA substrates with plastic PGA substrates. Fisher, however, teaches lands 22 are formed on an upper surface of the ceramic base substrate 46 and are connected to individual leads 26 of a frame 28. Accordingly, the ceramic base substrate 46 of Fisher is not a PGA substrate. Because the ceramic base substrate 46 of Fisher is not a substrate used in a PGA package, Applicant respectfully submits that it would not be obvious to replace the ceramic base substrate 46 with a plastic substrate simply because Mullen teaches that plastic PGA substrates are less expensive than ceramic PGA packages. Moreover, the Office Action presents no specific understanding or knowledge within the level of one of ordinary skill indicating that the cost disadvantages associated with ceramic PGA substrates, relative to plastic PGA substrates, can be extended to the non-PGA substrate 46 of Fisher. Accordingly, Applicant respectfully submits that it would not be obvious to replace the ceramic base substrate 46 of Fisher with a plastic substrate simply on the basis of cost.

Moreover, Applicant further submits that it would not be obvious to replace the ceramic base substrate 46 of Fisher with a plastic substrate because it is well known that the plastic substrates of Mullen have a lower thermal conductivity than ceramic substrates. Applicant respectfully submits that replacing the ceramic base substrate 46 of Fisher with a plastic substrate of Mullen would significantly decrease the transfer of heat generated by chips 12 within the micromechanical package 10 of Fisher to outside the micromechanical package 10, thereby degrading the performance characteristics of the micromechanical package 10 of Fisher. Accordingly, Applicant respectfully submits that it would not be obvious to replace the ceramic base substrate 46 of Fisher with a plastic substrate because such a replacement would render the micromechanical package 10 of Fisher unsatisfactory for its intended use. See M.P.E.P. §2143.01(V).

For at least the reasons presented above, Applicant respectfully submits that it would not be obvious to replace the ceramic base substrate 46 of Fisher with a plastic substrate simply on the basis of cost. Because it would not be obvious to replace the ceramic base substrate 46 of Fisher with a plastic substrate for the reasons proposed, Applicant respectfully submits that it would not be obvious to incorporate the stiffener of Mullen into Fisher for reasons presented in Applicant's amendment dated October 5, 2006. For at least these reasons, Applicant respectfully submits that the combination of Fisher in view of Mullen fails to render claim 12 obvious.

Claims 13, 14 and 16 depend from claim 12 and, therefore, include each and every element recited in claim 12. Accordingly, Applicant respectfully submits that the combination of Fisher in view of Mullen fails to render claims 13, 14 and 16 obvious for at least the reasons presented above with respect to claim 12.

Claim 15 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Fisher in view of Mullen and further in view of Akram.

Claim 15 depends from claim 12 and, therefore, includes each and every element recited in claim 12. As shown above, the combination of Fisher in view of Mullen fails to render claim 12 obvious. Moreover, Akram does not contain any teaching which, when combined with Fisher in view of Mullen, renders claim 12 obvious. Accordingly, Applicant respectfully submits that the combination of Fisher in view of Mullen and Akram fails to render claim 15 obvious for at least the reasons presented above with respect to claim 12.

CONCLUSION

For the foregoing reasons, reconsideration and allowance of claims 1-5 and 12-16 of the application as amended is requested. The Examiner is encouraged to telephone the undersigned at (503) 222-3613 if it appears that an interview would be helpful in advancing the case.

Respectfully submitted,

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